DOCUMENT RESUME

ED 245 183 CS 007 566

AUTHOR Varnhagen, Connie K.; Goldman, Susan R.
TITLE Text Cohesion and Comprehension: A Comparison of Prose Analysis Systems.
PUB DATE Apr 84
NOTE 28p.; Paper presented at the Annual Meeting of the American Educational Research Association (68th, New Orleans, LA, April 23-27, 1984).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Processes; Coherence; *Cohesion (Written Composition); Connected Discourse; Decoding (Reading); Elementary Secondary Education; Higher Education; *Language Processing; *Reading Comprehension; Reading Processes; *Reading Research; *Recall (Psychology)

ABSTRACT

To test three specific hypotheses about recall as a function of four categories of logical relations, a study was done to determine whether logical relations systems of prose analysis can be used to predict recall. Two descriptive passages of naturally occurring expository prose were used. Each text was parsed into 45 statements, consisting of predicate proposition and modifier units. The explicit and implicit relations between the statements were specified, and the relationships of statements were classified as conjunctive, disjunctive, implicative, or contrastive. Average reading seventh and ninth grade students and adults read both texts. They wrote their recall both immediately following the reading of each text and following a 1-week delay. Statement recall was used to test out a probability model, and compared with predicted recall for each grade level and recall time. Data indicated that analysis of logical relations in a text for predicting recall of information provides a reasonable representation of recall of expository prose by adolescents and adults. Data also indicated that the system of logical relations provides a more adequate account of adults' recall than do other theory based systems, and in the absence of explicit, top-level globally cohesive information, the logical relations system provides a better presentation of adolescents' as well as adults' recall for expository prose. (CRH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
X Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED245183

Text Cohesion and Comprehension:

A Comparison of Prose Analysis Systems

Connie K. Varnhagen
Centre for the Study of Mental Retardation
University of Alberta

Susan R. Goldman
University of California, Santa Barbara

Presentation to the American Educational Research Association, New Orleans, April 1984

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Connie K. Varnhagen
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CS007 566

Stories, essays, and other types of written discourse consist of information that is related to other information in the discourse in some logical manner. These underlying relations provide cohesion of the information and make the text an integrated whole rather than a disjoint sequence. Understanding a text thus involves comprehending the relations that tie together the information in the text. As a result, adequate models of text comprehension need to consider the nature of these relations between units of information and how individuals discover and use these relations in order to comprehend text.

Different theories of text comprehension have addressed these issues of text relations with different degrees of success. An adequate account of text cohesion must be specific enough to explain coherence and predict memorability of the related information. In an attempt to identify an adequate approach to prose comprehension, this study compares the ways in which four different systems of prose analysis describe the underlying relations in a text and predict recall for the related information. The four systems contrasted are: (1) Johnson's importance level analysis (Johnson, 1970); (2) Meyer's content structure system of prose analysis (Meyer, 1975); (3) Kintsch's argument repetition system and information processing model (Kintsch & van Dijk, 1978); and (4) a prose analysis system and information processing model based on the logical relations between units of information in a text (Varnhagen,

1984).

The system of prose analysis developed by Johnson (1970) is empirically based. Antedating the more formal prose analysis systems examined in this study, Johnson developed an objective method for parsing narrative and expository text into psychologically valid units and determining the perceived importance of each of the units in relation to the rest of the text. Johnson (1970) found that subjects were quite consistent in their division of text into "pausal units", representing separate ideas, and in rating the thematic importance of each unit. Furthermore, Johnson found recall of these idea units to be directly related to their preceived thematic importance.

Although Johnson's notion that the more important some unit of information is the more likely it is to be recalled is appealing, the lack of any theoretical basis is disquieting. The definition of importance as a construct is not distinguishable from its empirical identification within a particular text. Thus, although Johnson's system has been shown to have a certain amount of predictive validity, it is impossible to critically evaluate it without any theoretical basis.

Meyer's (1975) system of prose analysis, on the other hand, has a very strong theoretical basis. She has established cohesion of text units according to a rule based system that represents an extension of semantic grammar approaches to describing intra-sentence relations. Meyer

describes semantically related text information within a hierarchically organized content structure. Recall is posited to be a function of level in the content structure; in general, however, Meyer's system of prose analysis picks out the main idea(s) of a text and information which directly supports the main idea(s) as highly likely to be recalled. Empirical recall findings (cf. Meyer, 1975; Meyer, Brandt, & Bluth, 1980) support this notion to a certain extent. However, a better predictor of recall than level in the content structure seems to be the functional relationship some unit of information has with the rest of the text (cf. Dunn, Mathews, & Bieger, 1979). As a result, the strength of Meyer's system may not be so much due to her specification of a hierarchical structure but to describing functional relations between text units.

Kintsch's (Kintsch & van Dijk, 1978) system of prose analysis has a very different theoretical basis. His system is based on the notion that relations between units of text are a function of referential coherence, or the repetition of small pieces of information in the text. Kintsch has developed a simple rule based system for parsing text into propositions and relating the propositions through semantic overlap.

Kintsch has also developed an information processing model for simulating text processing and predicting recall of information through a probability equation. Information predicted to be most likely to be recalled generally consists of the topic sentence for each paragraph of a

text. Various studies (e.g. Kintsch & van Dijk, 1978; Kintsch & Vipond, 1979; Miller & Kintsch, 1980), employing very short and simple texts, indicate that information with more semantic overlap with other information in the text is better and more durably recalled than information with less semantic overlap. Slightly more rigorous tests have been less successful, however. Regardless of the reasons, Kintsch's information processing model comprises an important attempt to more exactly represent prose processing and predict recall.

Although each of these three systems suffers from a number of flaws, each has a particularly appealing aspect: Johnson's concept of an idea unit, representing a complete idea as opposed to a proposition representing a very atomistic word concept, leads to very simple text bases. This is appealing to the researcher faced with explaining recall of longer, more complicated texts than are generally represented by propositional text bases. Meyer's notion that a text can be described in terms of some set of relations between units of information is consistent with current theories of learning and memory. Finally, Kintsch's information processing model provides a vehicle for more exactly testing recall predictions made by a particular prose analysis system. A more adequate approach to prose analysis and comprehension should ideally include the more appropriate and appealing aspects of these other systems.

The fourth system examined in this study incorporates a more simplistic text base, a taxonomy of relationships between units of information, and an information processing model in the analysis of logical relations in prose. The logical relations prose analysis system represents an extension of Trabasso's (Trabasso, Secco, & van den Broek, in press) causal chain analysis of narratives. Trabasso has developed a representation of story comprehension based on causal relationships between narrative events. He argues that as a comprehender processes story events he or she infers a series of causal relationships between incoming information and prior information. The actual relationships may or may not be explicitly marked by syntactic connections in the text. These relationships are determined according to Mackie's (1976) tests of causal necessity and sufficiency.

According to Trabasso, the comprehender represents a story as an interconnected chain of causally-related events. Some story information, such as an elaboration about why some action was undertaken, does not fit into the causal chain and is termed "dead-end". Trabasso postulates greater recall for causal chain than for dead-end events. Furthermore, the more causal connections some unit of information has with the rest of the text, the more likely it is to be recalled.

Trabasso (personal communication; Trabasso, Secco, & van den Broek, in press) has analyzed protocols from several of Stein and

Glenn's (1979) original recall experiments several later experiments. These analyses reveal consistently greater recall for causal chain than dead-end events within story information categories and across stories differing in terms of the proportion of causal chain to dead-end events. Furthermore, information was better and more durably recalled as a function of the number of causal relations with the rest of the story.

There are two major difficulties with Trabasso's causal chain analysis system that make it untenable for predicting prose recall. The first concerns its scope: Trabasso's system deals only with causal relations between state and event information in stories. These types of information are most common to narrative text and much less common in expository prose. Thus, the analysis system is applicable only to narrative forms of text. Secondly, the relations themselves are poorly specified and Trabasso considers only causal relations which actually represent only a subset of a broader taxonomy of logical relations.

This sort of broader taxonomy of logical relations is found in Table 1. These relationships can be distinguished on the basis of the inherent complexity of the relation and how tightly it connects the related information. Two broad classes of relations are the weaker coexistence relations and the stronger causal and logical relations. Within each of these classes, the connected information can express a "true" relationship in that the relation unites the information in some way, or a "false"

relationship indicating that one or more of the statements is not possible.

Considering first the coexistence relations, conjunctives unite information in such a way that the statements form a complex concept, event, or situation. Thus, conjunctives provide a positive or true association between the related statements. Disjunctives, on the other hand, specify a negative or false association between the statements. A disjunctive specifies mutually exclusive alternatives; as such, the disjunctive relation unites information by distinguishing independent or disjoint units. Thus, conjunctives and disjunctives serve opposite roles in describing coexistence relationships; whereas conjunctives describe associative relationships, disjunctives describe dissociative relationships.

Much of the information in a text is not combined through the loose associative framework described by the coexistence relations; rather, it is combined through complex causal and logical relations. These types of relations are expressed, in a positive sense, as implicatives and, in the negative sense, as contrastives. The causal and logical relationships represented by the implicative is one in which some antecedent event or condition provides at least a partially sufficient reason or condition for a resulting consequent. Furthermore, the antecedent is at least partially necessary for the consequent. That is, not only does the antecedent provide the condition for the consequent to be expressed but the consequent is not possible in the absence of the antecedent.

These two conditions meet, to some extent, the tests of logical sufficiency and necessity, respectively, described by Mackie (1976). Unlike Trabasso's strict criteria of sufficiency and necessity defining causal relations (physical and logical implicatives in this system), however, an implicative may violate one or both of these conditions to a certain extent. The subcategories of the implicatives described in Table 1 are distinguished in terms of how well each meets the tests of sufficiency and necessity. These same criteria of logical sufficiency and necessity are used to determine contrastive relations. However, in a contrastive, either the antecedent or consequent is negative; that is, either the antecedent fails to result in some normally occurring consequent or an antecedent that normally has the opposite effect actually results in the consequent.

These different types of relations are posited to require different amounts of processing in order to comprehend them. For example, information can be loosely associated through the coexistence class of relations with very little processing or controlled attention on the part of the comprehender. In order to determine and comprehend a more complex causal or logical relation, on the other hand, the comprehender must distinguish antecedent and consequent information and determine the necessity and sufficiency of the antecedent for the consequent. This means-ends analysis extracts greater processing demands than simply

associating information.

Consistent with Kintsch's (Kintsch & van Dijk, 1978; Kintsch & Vipond, 1980) information processing model, this extended processing is hypothesized to increase the likelihood of remembering the related information. Thus, information related through the more complex logical and causal relations, the implicatives and contrastives, is hypothesized to be better recalled than information related through the weaker coexistence relations, the conjunctives and disjunctives.

It is reasonable to assume that encountering information that is negatively related through the dissociative and contrastive relations initially disrupts processing of the relationship. In order to comprehend this type of negative relation, then, greater demands are placed on processing than on comprehending the corresponding positive relation. These extra demands can be translated into a greater probability of recall for negatively related information. Thus, it is predicted that the disjunctive relation increases the likelihood of recall beyond that of the conjunctive. Along the same line of reasoning, the contrastive should have greater influence over recall than the implicative relations.

Similar predictions about recall can be made within the broad categories of relations. Two conjunctive relations and seven types of implicative relations are identified in the taxonomy of logical relations. It is entirely likely that these different types of conjunctives and implicatives

differentially affect recall for the related information. However, the initial test of this system of prose analysis reported here examines only the hypotheses about recall as a function of the conjunctive, disjunctive, implicative, and contrastive categories of relation; fine distinctions in probability of recall within these categories have not been considered at this early stage.

Three specific hypotheses about recall as a function of these four catetories of logical relations were examined in this study: (1) The number and type of relations some unit of information has with other units in the text effects the likelihood of recall for that information, (2) Implicative relations have a greater influence on recall than conjunctive relations; and (3) The dissociative categories (i.e., disjunctives and contrastives) have a greater influence on recall than the corresponding associative categories (i.e., conjunctives and implicatives). The ways in which the number and type of relationships influences recall can be represented by the probability equation, $P(\text{recall}) = 1-(1-p_c)^{n_c}(1-p_d)^{n_d}(1-p_i)^{n_i}(1-p_{co})^{n_{co}}$, where the p's represent the base probability of recalling an information unit connected to some other unit through that relation (conjunctive, disjunctive, implicative, and contrastive, respectively) and the n's represent the number of times that relation is expressed.

The initial concern of this study was to test out whether this logical relations system of prose analysis can be used to predict recall.

If the system does an inadequate job of predicting recall, than it is senseless to compare it with the other 3 systems. Two descriptive pasages of naturally occurring expository prose were selected. The type of passage selected is a common type of prose encountered in junior high and high school classes. The Horse's Milk text describes the use of horse's milk throughout history. The Names text traces the origin and history of names. The texts were each about 325 words in length and had about a seventh-eighth grade readability level.

Each text was parsed into 45 statements, consisting of predicate proposition and modifier units. The explicit and implicit relations between the statements were specified using the logical relations described in Table 1. Each statement was compared to each prior statement in the text in order to determine any relationship with the prior information. Once a relationship was determined, the type was identified. A relationship that fit neither the test of logical necessity nor sufficiency was identified as a conjunctive. If the relationship further dissociated information, then it was identified as a disjunction. If a relationship satisfied one or both tests, the implicative relation was identified. Finally, if the relationship dissociated the related information but still fit one of the tests then the relation was identified as contrastive.

Individual probability equations, based on the number and type of relations identified, were written for each statement. These hypothetical

recall probabilities were compared with actual recall using a parameter estimation program called STEPIT (Chandler, 1965) to examine the efficacy with which the logical relations system predicts recall.

Average reading seventh and ninth grade students and adults read both texts. They wrote their recall both immediately following reading each text and following a one week delay. Their immediate and delayed recall was used to test out the probability model. Statement recall was compared with predicted recall for each grade level and recall time. The resulting parameter estimates and chi-square evaluations for the model fits are found in Table 2.

The chi-square evaluation is used to examine the first hypothesis that recall is a function of the number and type of logical relations in the text. A "good" fit between the probability equation and the actual recall data is indicated by a nonsignificant chi-square value, indicating very little difference between predicted and actual recall values. However, Kintsch (cf. Kintsch & van Dijk, 1978; Kintsch, 1979; Miller & Kintsch, 1980) argues that chi-square values within four times the critical chi-square value are not excessive when trying to fit complex probability models. As can be seen in Table 2, with the exception of the adult data for the Horse's Milk text and adult immediate recall for the Names text, the probability model based on logical relations provides a good representation of the actual recall data. In other words, the model fits

indicate that recall of these texts is generally a function of the number and type of logical relations in the text. The correlations between predicted and actual recall tend to support the chi-square evaluations.

In order to test the second hypothesis that implicative relations require more processing for comprehension and therefore should have a greater influence on recall than conjunctive relations, the individual parameter estimates were compared using Z tests for differences in proportions. Across grade levels and recall times, the implicative estimate is larger than the conjunctive; this overall difference is greater for the Names text than the Horse's Milk text. The individual parameter estimates are more variable, however. The adult model fits consistently show this pattern of difference between implicative and conjunctive estimates. In addition, the seventh grade immediate and delayed recall estimates show this pattern with the Names text. All the other estimates are either approximately equal or else demonstrate the opposite pattern. Thus, although implicatives tend to have a greater influence on recall than conjunctives, this function is not terribly strong, especially for the adolescents.

The third hypothesis about the relative influence of associative and dissociative relations is somewhat more difficult to evaluate statistically. This is because very few dissociative types of relations were observed in the texts; there were a total of 2 disjunctives identified in the

Horse's Milk text and 7 in the Names text and 2 and 3 contrastives in the Horse's Milk and Names texts, respectively. Even so, there is a certain amount of support for the hypothesis that disjunctives have a greater influence on recall than conjunctives, at least for the Horse's Milk text. Averaging across grade levels and recall times, the disjunctive estimate was larger than the conjunctive. This overall difference mirrors the ninth grade and adult estimates for both immediate and delayed recall data. This pattern isn't very clear with the Names text, however. Although seventh graders have larger disjunctive than conjunctive estimates for the Names text, the differences are slight. In addition, the conjunctives generally had a greater effect on recall of the Names text than the disjunctive--an opposite trend than was predicted.

Finally, the contrastives were very poorly represented in the model fits and did not support the hypothesis that contrastives have a greater influence on recall. Either there are not a sufficient number of contrastives for the model to adequately consider contrastives or the subjects do not process and comprehend them as was hypothesized. Given the inconsistent disjunctive results, the former may be the more likely case.

As indicated above, the first concern of this study was to examine the logical relations prose analysis system and test the efficacy with which the information processing model can be used to predict

recall of expository prose. Many analyses need to be pursued in order to pin down exactly where the logical relations system works well and less well and more experimental studies are needed to more finely test out the various predictions. However, these intital analyses seem to provide quite strong support for the analysis of logical relations.

How well does this system fare with respect to the other approaches? The second major concern of this study was to compare the four systems of prose analysis in order to determine which system or combination of systems provide the best recall predictions. Separate analyses of the recall data with respect to each of the systems of prose analysis demonstrated that each was more-or-less successful in accounting for the recall data. As a result, all four systems were entered into the regression analyses.

Statement recall was used as the dependent measure. Each of the systems employs a different text base in its analysis; however, each can be reduced to a statement level text base with very little loss in predictive ability. An examination of the idea units used with the Johnson analyses revealed that they were almost identical to statements. According to Meyer's system, analysis of statement recall translates into an analysis of lexical predicates and in Kintsch's system, it translates into an analysis of predicate propositions. In each system, these units are accorded greater importance in the analysis than their associated

arguments and modifiers; lexical predicates are consistently located at a superordinate level in the content structure and predicate propositions are consistently more likely to be selected or reinstated for further processing. Thus, although the comparative analysis was simplified by examining statement recall, no essential information is lost from the predictions made by the various systems.

In order to facilitate interpretation of the regression analyses, the four sets of predictions were compared for the two texts. The correlations between the predictors are found in Table 3. The tau values indicate a relatively strong and consistent relationship between Johnson's predictions and each of the others but no relationship within the other three sets. This finding of overlap of Johnson's predictions with the other sets is not necessarily unexpected. The Meyer, Kintsch, and logical relations systems are all predicated on different theoretical frameworks and therefore are expected to make different predictions about recall. Johnson's system, on the other hand, is empirically based and may be expected--provided each of the other systems has a certain amount of predictive validity--to pick up some of each of the theoreticaly-based predictions. As a result, the Johnson system predictions may be expected to account for a significant amount of the variance in the regression analysis.

The best fitting stepwise regression equations for each text are found in Table 4. As expected, the predictions made by Johnson's system are picked up in all but one equation. With the exception of that one consistent finding, however, the two texts have quite different patterns of predictions. Consider first the Horse's Milk text. At immediate recall, developmental differences are quite apparent. In addition to Johnson's system, Kintsch's predictions are picked up to represent seventh grade recall. This indicates that seventh graders are recalling topically important information. Ninth graders' recall is represented by both Johnson's and Meyer's system, indicating that ninth graders are recalling topically important information and supporting details. Finally the adult immediate recall for the Horse's Milk text is best represented by Johnson's and the logical relations systems. Thus, adults' recall can be represented by topical information and elaborative details about the use of horse's milk that are picked up by the system of logical relations.

These patterns of recall, indicating that younger subjects recall the more topical main ideas whereas the older subjects recall supporting and elaborative information is not as clear for delayed recall of the Horse's Milk text. Meyer's main and supporting idea predictions are weakly supported in both seventh and ninth grade recall. Johnson's topical information is included in the seventh grade representation and Kintsch's topic sentences are included in the ninth grade representation. No fit

could be obtained for adult delayed recall.

The predictions made by Johnson's and the logical relations systems predominate in the Names text recall representations.

The size of the weight given to the logical relations predictions shows some interesting trends across ages and recall times, however. More emphasis is given to logical relations by the seventh graders and adults. In addition, more emphasis is given to the relations at delayed than at immediate recall. The equations for the Names text also account for, on the average, 6% more of the variance than the equations for the Horse's Milk text, indicating slightly more accurate predictive fits for the Names text than for the Horse's Milk text.

The two texts and the predictions about recall made by the four systems of prose analysis are currently being examined in greater detail in order to trace out the differences between the predictive fits. One difference between the two texts is that Horse's Milk appears to be more globally coherent, or in Meyer's terminology, to have a more obvious top-level structure. The use of horse's milk throughout history is described as passing from one country to another through the spoils of war, etc. Thus, the separate descriptions are closely associated. The Names text, on the other hand, is more locally coherent, and its top-level structure is not as obvious. The development of the use of names is described separately for each country, with no explicit

association made between the various countries.

The global coherence of the Horse's Milk text seemed generally important in the representation of the younger subjects' recall--especially for the ninth graders--but the adult's recall was better represented by the more local coherence predicted by the logical relations system. When the global relations are less obvious, as in the Names text, it appears that all subjects' recall can be represented in terms of local coherence predicted by the logical relations system. In addition, there is no deficit in recall as a function of local versus global coherence; recall for the Horse's Milk and Names texts was comparable within each grade level and recall time. Recall of the Horse's Milk text, on first impression, seems to emphasize topic sentences. Recall of the Names text, on the other hand, seems to emphasize the historical facts and details.

If this finding holds up under closer scrutinization, then it has important educational implications. The goals of learning from a particular text must be carefully considered when writing or selecting the text. If some overall integration of information is important, then building in and supporting main ideas is essential. If, on the other hand, factual learning is required, the individual facts may need to be emphasized and elaborated upon. According to the findings reported here, adults read for details but junior high and high school students are not necessarily

sensitive to this type of information. Thus if factual knowledge is desired, then junior high and high school texts should emphasize and detail these facts.

In summary, this study examined the effectiveness of using an analysis of logical relations in a text for predicting recall of information in the text. In addition, the predictions made by the logical relations system was compared with predictions made by Johnson's importance level analysis, Meyer's content structure analysis, and Kintsch's argument repetition system. This study has demonstrated that the analysis of logical relations provides a reasonable representation of recall of expository prose by adolescents and adults. Furthermore, it demonstrates that the system of logical relations provides a more adequate account of adult's recall than other theoretically-based prose analysis systems and, at least in the absence of explicit, top-level, globally cohesive information, the logical relations system provides a better representaiton for adolescents' as well as adults' recall for expository prose.

References

Chandler, P.J. *Subroutine STEPIT: An Algoritnm that finds the values of the parameters which minimize a given continuous function.* Bloomington: Indiana University, Quantum Chemistry Program Exchange, 1965.

Dunn, B.R., Mathews, S.R., & Bieger, G. *Individual differences in the recall of lower-level textual information.* (Technical Report No. 150). Champaigne-Urbana, IL: Center for the Study of Reading, University of Illinois, 1979. (ERIC Document Reproduction Service No. ED 181 448).

Johnson, R.E.(1970) Recall of prose as a function of the structural importance of the linguistic unit. *Journal of Verbal Learning and Verbal Behavior, 9,* 12-20.

Kintsch, W.(1979) On modeling comprehension. *Educational Psychologist, 14,* 3-14.

Kintsch, W., & van Dijk, T.A.(1978) Toward a model of text comprehension and production. *Psychological Review, 85,* 363-394.

Kintsch, W., & Vipond, D.(1978) Reading comprehension and readability in education practice. In L.G. Nilsson (Ed.), *Perspectives on memory*

research. Hillsdale, NJ: Erlbaum.

Mackie, J.L. Causes and conditions.(1976) In M. Brand (Ed.), *The nature of causation*. Urbana, Il.: University of Illinois,.

Meyer, B.J.F.(1975) Identification of the structure of prose and its implications for the study of reading and memory. *Journal of Reading Behavior, 7*, 7-47.

Miller, J.R., & Kintsch. W.(1980) Readability and recall of short prose passages: A theoretical analysis. *Journal of Experimental Psychology: Human Learning and Memory, 6*, 335-354.

Stein, N.L., & Glenn, C.G.(1979) An analysis of story comprehension in elementary school children. In R.O. Freedle (Ed.), *Advances in discourse processes*, Vol. 2: *New directions in discourse processing*. Norwood, NJ: Ablex.

Trabasso, T., Secco, T., & van den Broek, P.(in press) Causal cohesion and story coherence. In H. Mandl, N.L. Stein, & T. Trabasso (Eds.), *Learning and comprehension of text*. Hillsdale, NJ: Erlbaum.

Varnhagen, C.K.(1984) *Text Cohesion and Comprehension*. Unpublished doctoral dissertation, University of California, Santa Barbara.

Table 1. Taxonomy of logical relations

CONNECTIVE	DESCRIPTION
conjunctive	Combines units of information
intentional	Provides an associative framework connecting the information
temporal	Provides a temporal framework connecting the information
disjunctive	Separates units of information
implicative	Logically relates antecedent and consequent information
enable	Antecedent allows the occurence of the consequent
motivational	Antecedent provides the motivating force for the consequent
purposive	Consequent is undertaken for the purpose of the antecedent
psychological	Antecedent causes a psychological consequent
physical	Antecedent causes a physical consequent
logical	Antecedent and consequent are logically related
conditional	Antecedent must be true in order to cause the consequent
contrastive	The antecedent information fails to cause the consequent

Table 2. Parameter estimates based on the system of logical relations

Horses' Milk text

		P_{Conj}	P_{Disj}	P_{Impl}	P_{Cont}	X^2	r
Immediate Recall	7th	.07	.002	.04	.008	179.38+	.362*
	9th	.10	.24	.08	.01	180.45+	.284*
	Adult	.24	.67	.31	0	260.98	.406*
Delayed Recall	7th	.02	0	.01	.005	85.59+	.210
	9th	.02	.06	.03	.003	139.41+	.147
	Adult	.07	.25	.16	.15	234.17	.148

Names text

		P_{Conj}	P_{Disj}	P_{Impl}	P_{Cont}	X^2	r
Immediate Recall	7th	.02	.04	.06	0	124.78+	.423*
	9th	.20	.003	.14	.10	192.45+	.455*
	Adult	.22	.003	.39	.41	233.14	.467*
Delayed Recall	7th	.008	.02	.02	0	121.72+	.523*
	9th	.04	.02	.03	0	90.22+	.345*
	Adult	.07	0	.21	.09	173.41+	.492*

+ not excessive

* $p < .05$

Table 3. Kendall's tau coefficients between the four sets of predictor values

Horses' Milk text

	Meyer	Kintsch	Logical Relations
Johnson	.32*	.10	.26*
Meyer		.03	.22
Kintsch			.02

Names text

	Meyer	Kintsch	Logical Relations
Johnson	.36*	.39*	.26*
Meyer		.16	.02
Kintsch			.14

*$p < .01$

Table 4. Best fit stepwise regression equations for predicting recall

Horses' Milk text

		equation	R^2
Immediate Recall	7th	.11J + .43K	.32
	9th	.07J + .03M + .30	.26
	Adult	.07J + .36R + .21	.22
Delayed Recall	7th	.07J + .01M	.28
	9th	1.15K + .03M + .24	.20
	Adult	NO FIT	

Names text

		equation	R^2
Immediate Recall	7th	.04J + 1.04R	.25
	9th	.13J + .29R	.38
	Adult	.09J + .62R	.27
Delayed Recall	7th	.06J + 2.18R - .04M - .26	.40
	9th	.06J + .38R	.29
	Adult	.06J + .73R	.32